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The effect of chewing gum on intestinal functions, postoperative pain, and early discharge after isolated coronary bypass surgery

Postoperatively chewing gum in cardiac surgery

Habibe Çevik[1], Rahşan Çam[2], Mesut Engin[3], Senol Yavuz[3]
[1] Department of Nursing, University of Health Sciences, Bursa Yuksek Ihtisas Training and Research Hospital, Bursa
[2] Department of Surgical Nursing, Faculty of Nursing, Adnan Menderes University, Aydin
[3] Department of Cardiovascular Surgery, University of HealthSciences, Bursa Yuksek Ihtisas Training and Research Hospital, Bursa, Turkey

Abstract
Aim: Abdominal distension is a significant problem that may occur after coronary artery bypass graft surgery (CABG). In this study, we aimed to investigate the effects of postoperative gum chewing on bowel function, pain levels, and early discharge in patients who underwent isolated CABG surgery.
Material and Methods: Patients who underwent isolated CABG surgery at the Health Sciences University were prospectively included in this non-randomized study between June 2021 and December 2021. The study group (single-use gum chewed for at least 15 minutes (min) and a maximum of 30 minutes each time, at the 4th, 6th, 8th, and 10th hours after checking for swallowing reflex and orientation 4 hours after extubation) included 24 patients. With 24 controls, 48 patients were thus included in the study.
Results: There was no difference between the groups regarding gender, hypertension (HT), body mass index, diabetes mellitus, chronic obstructive pulmonary disease rates, education levels, and defecation habits. A significant increase in bowel sounds and a significant decrease in pain levels were detected 15 to 30 minutes after chewing gum at all times, during the 4th, 6th, 8th, and 10th postoperative hours ($P < 0.001$ for all parameters).
Discussion: Chewing gum early after CABG may allow bowel functions to return earlier. It can also reduce pain levels. However, there was no significant effect on early discharge.

Keywords
Coronary Artery Bypass Graft, Postoperative Term, Chewing Gum, Postoperative Care

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Corresponding Author: Mesut Engin, Department of Cardiovascular Surgery, University of HealthSciences, Bursa Yuksek Ihtisas Training and Research Hospital, Bursa, Turkey.
E-mail: mesut_kvc_cor@hotmail.com P: +90 224 295 50 00
Corresponding Author ORCID ID: https://orcid.org/0000-0003-2418-5823
Other Authors ORCID ID: Habibe Çevik, https://orcid.org/0000-0003-2286-6211 · Rahşan Çam, https://orcid.org/0000-0002-0659-4861
Senol Yavuz, https://orcid.org/0000-0001-5246-0808
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Introduction

Today, coronary artery bypass graft (CABG) surgery is successfully applied in the treatment of atherosclerotic heart disease. Most of these operations are performed with cardiopulmonary bypass (CPB) [1]. Although CPB systems are technologically advanced, these operations involve serious surgery with prolonged anesthesia times. Therefore, various postoperative complications that affect all organ systems may occur [2].

Abdominal distension is a significant problem that may occur after coronary artery bypass graft surgery (CABG). It may occur due to prolonged bed rest and mobilization issues [3]. Although abdominal distention is a painful condition in the postoperative period, serious clinical problems such as paralytic ileus and gastric dilation may occur if the duration is prolonged [4]. There are suggestions such as early mobilization, fluid consumption, chewing gum, and hot application, to avoid abdominal distention. Postoperative gum chewing is highly recommended practice because it is easy for patients to adapt to, it can be easily applied, and it is economical [5]. Studies have shown that chewing gum at the 4th hour after the operation as the first oral nutrition reduces the ileus development [6].

In this study, we aimed to investigate the effects of postoperative gum chewing on bowel function, pain level, and early discharge in patients who underwent isolated CABG surgery.

Material and Methods

Patients who underwent isolated CABG surgery at the Health Sciences University between June 2021 and December 2021 were prospectively included in this study. Patients with a left ventricular ejection fraction greater than 40%, who had underwent elective isolated CABG surgery, and who did not have an impediment to chewing gum, were included in the study. Patients with preoperative dyspeptic complaints, combined surgery, or a history of abdominal surgery, were not included in the study. Patients who developed early postoperative mortality or morbidity (e.g., prolonged ventilation for12 hours, use of intra-aortic balloons) during this period and who refused to chew gum, were excluded from the study. Demographic data of the patients (age, gender, educational status, body mass index, etc.), operative data (operation time), and postoperative data (total hospitalization time of the patient, time to start oral intake, first flatus passing and stool output time, postoperatively evaluated bowel sound, postoperatively evaluated pain level, postoperative first mobilization time, hospitalization period), were recorded. The total hospital stay was calculated by considering the entire period between preoperative preparation and the time of the patient's discharge.

Sample Size Calculation

The sample included 48 patients undergoing isolated CABG surgery. To detect a statistically significant difference between the two groups with 96% power, a significance level of 0.05, and the possibility of type I error below 5%, the required sample size was calculated to be 24 patients per group. As gender differences were not significant difference in the reference studies, no distinction was made between men and women in the volunteer patients to be included in the study. All patients who met the inclusion criteria and volunteered to participate were included in the sample until the specified sample size was reached.

Chewing Gum (Study) Group

Following the removal of the intubation tube, patients were assessed for their ability to swallow and orientation after four hours. They were then instructed to chew a single-use gum for a minimum of 15 minutes and a maximum of 30 minutes at the 4th, 6th, 8th, and 10th hours). This group consisted of 24 patients.

Control Group

The chewing gum group was determined first within the specified date range. Then, 24 consecutive patients meeting the inclusion criteria were assigned to the control group. The study continued until both groups had 24 patients within the study period.

The timing for the patients to start chewing gum was based on the ERAS (Enhanced Recovery After Surgery) guidelines [5]. Swallowing reflex control was initiated once researchers observed that the patients could swallow without aspiration, by giving them swallow a small amount of water. Bowel sounds before and after each chewing were verified by the researcher with a stethoscope. To determine the duration of the first flatus after chewing gum, the patients were asked to verbally state. Pain assessments were assessed using the Visual Analogue Scale (VAS) at the postoperative 4th, 6th, 8th, and 10th hours for all patients [7]. Participants were provided with a 10-cm line representing a continuum from "no pain" and "worst possible pain". Participants were then asked to indicate their level of pain by making a handwritten mark on the line, with "no pain" being represented by a mark at the left end of the line and "worst possible pain" being represented by a mark at the right end of the line.

Statistical Analysis

Statistical analyses were performed in the JASP (Jeffrey's Amazing Statistics Program) software, (an open-source program developed by the University of Amsterdam that does not require a license) . Descriptive statistics of qualitative variables in the study were reported as frequency and percentage; while quantitative variables were presented with mean, standard deviation, median, minimum, and maximum values. The normality of quantitative variables was assessed using the Shapiro-Wilk test. The Mann-Whitney U test was used to compare two independent groups of quantitative variables. The quantitative variables were analyzed using the Wilcoxon test to compare two dependent groups. The Yates, Fisher, and Pearson chi-square tests were used for independent group comparisons of qualitative variables. Results below 0.05 were considered statistically significant in all statistical analyses.

Ethical Approval

This study was approved by the Ethics Committee of Adnan Menderes University, Faculty of Nursing Non-Interventional Clinical Research Ethics Committee (Date: 2020-09-07, No: 50107718-050.04.04). After obtaining the ethics committee's approval, written permission (Date: 2020-10-26, No: 31234050-799) was obtained from the management of Health Sciences University, Bursa Yuksek Ihtisas Training and Research Hospital.

Results

A total of forty-eight patients were included in the study; and their preoperative characteristics and demographic data are

presented in Table 1. There were twenty-four patients in the study group with a median age of 57.5 (31-68), and there were twenty-four patients in the control group with a median age of 63 (30-76) (P= 0.042). There was no difference between the groups in terms of gender, hypertension (HT), body mass index (BMI), diabetes mellitus (DM), chronic obstructive pulmonary disease rates (COPD), education levels, and defecation habits. Operative and postoperative data of the patients are presented in Table 2. There was no significant differences between the groups in operation times, perfusion times, postoperative first mobilization hours, pain levels at the 4th hour after extubation, or total hospital stay. The first postoperative bowel sound, time to first flatus, and time to first defecation were significantly earlier in the study group (P < 0.001 for all parameters). Table 3 presents the evaluation of pain and bowel sounds in the gum-chewing group before and 15 to 30 minutes after chewing gum. A significant increase in bowel sounds and a significant decrease in pain levels were observed 15 to 30 minutes after chewing gum at all times, at the 4th, 6th, 8th, and 10th postoperative hours (P < 0.001 for all parameters).

Table 1. Demographic data and preoperative features of the patients

Variables	Study Group (N= 24)	Control Group (N= 24)	P value
Age(years)	57.5 (31- 68)	63 (30-76)	0.042 ‡
Female gender, n (%)	8 (33.3%)	7 (29.2%)	1.000*
Hypertension, n (%)	11 (45.8%)	14 (58.3%)	0.386*
BMI, kg/m^2	27.3 (21.7- 42.9)	27 (21.8- 38.8)	0.599‡
Diabetes Mellitus, n (%)	11 (45.8%)	8 (33.3%)	0.376*
COPD, n (%)	2 (8.3%)	1 (4.1%)	1.000*
Educational levels, n (%)			0.352*
Illiterate or primary school graduate	1 (4.2%)	4 (16.7%)	
Secondary school graduate	14 (58.3%)	13 (54.2%)	
High school or university graduate	9 (37.5%)	7 (29.2%)	
Preoperative hospital stays, days	5.5 (3- 22)	6 (1- 12)	0.631‡
Defecation habits, (%)			0.252*
Once a day	14 (58.3%)	9 (37.5%)	
Twice a day	0 (0%)	1 (4.1%)	
Once in two days	10 (41.6%)	14 (58.3%)	

‡Mann Whitney U test (Data is expressed as median (minimum-maximum)), *Chi-square or Fisher's Exact Test, BMI: Body mass index, COPD: Chronic obstructive pulmonary disease,

Table 2. Operative and postoperative features of the patients

Variables	Study Group (N= 24)	Control Group (N= 24)	P value‡
Operation time, hours	4.7 (4- 5.5)	4.5 (2.5- 7.5)	0.535
PO first mobilization, hours	30 (21- 54)	28.2 (23- 48)	0.649
PO first bowel sound, hours	11 (8.5- 14.5)	12.5 (8- 16)	<0.001
PO first flatus, hours	20.5 (9- 33.5)	28.5 (19- 69.5)	<0.001
PO first defecation time, hours	67 (48- 101)	94.5 (66- 144)	<0.001
Total hospital stays, days	13 (3- 30)	19 (6- 23)	0.429
Pain level post-extubation 4. hours	5.5 (3- 10)	5.5 (0- 10)	0.843

‡Mann Whitney U test (Data is expressed as median (minimum-maximum)), PO: Postoperative

Table 3. Evaluations of pain and bowel sound in the gum-chewing group before and 15-30 minutes after chewing gum

Variables*	Before Chewing (N= 24)	After Chewing (N= 24)	P value ^{w}
4. hours bowel sound	5 (4- 8)	8 (6- 12)	<0.001
6. hours bowel sound	6 (3- 13)	9.5 (6- 18)	<0.001
8. hours bowel sound	6 (3- 14)	10 (7- 20)	<0.001
10. hours bowel sound	6.5 (5- 14)	12 (8- 18)	<0.001
4. hours pain level	5.5 (3- 10)	3 (1- 9)	<0.001
6. hours pain level	5 (2- 10)	3 (2- 10)	< 0.001
8. hours pain level	5 (2- 10)	3 (0- 9)	<0.001
10. hours pain level	5 (2- 9)	3 (0- 8)	<0.001

*After extubation, ^{w} Wilcoxon test.

Discussion

CABG surgeries with cardiopulmonary bypass are commonly performed, and technological advances, mortality rates have reduced mortality rates to 1% [8]. However, morbid complications affecting multiple organ systems may still occur after these operations. Gastrointestinal complications occur in up to 6% after cardiac surgeries [4]. Abdominal distention is one such complication and can be painful, potentially leading to ileus. In this prospective non-randomized single-center study, we demonstrated that early gum chewing positively affects bowel function after CABG surgery and reduces postoperative pain levels.

Advanced age plays a role in the development and prognosis of many diseases. Because our study was not a randomized controlled trial, age was slightly higher in our control group (P = 0.042). This may affect the study results. However, there are also studies indicating that advanced age does not affect postoperative bowel sounds [9,10]. Auscultation of bowel sounds is an important manual assessment method, but it lacks objectivity. In our study, bowel sound assessments were performed manually. An electronic bowel sound recording system has been developed and is safely used in bowel sound analyses [11].

Most studies investigating postoperative outcomes with gum chewing have focused on abdominal surgery. In a study by Turkay et al. [12], the effect of postoperative gum chewing on pain and bowel movements in patients who underwent laparoscopic total hysterectomy was investigated. In the study group (N = 58), patients began chewing sugarless gum every two hours for fifteen minutes, beginning at the second postoperative hour. The control group (N = 51) did not chew gum and patients received standard postoperative care. The study demonstrated the positive and significant effects of chewing gum on pain and bowel movements. In a meta-analysis study by Roslan et al. [13], the effect of chewing gum on the ileus after colorectal surgery was investigated. The meta-analysis, which included 970 patients across 10 studies, concluded that postoperative gum chewing significantly reduced the incidence of ileus. Unlike these patient groups, our study focused on patients who underwent CABG surgery. No cases of ileus were observed in our study. We demonstrated that chewing gum had positive and significant effects on pain and bowel movements.

There have been studies investigating the effects of chewing gum on postoperative outcomes following surgical operations without peritoneal incisions. A study conducted on adolescent idiopathic scoliosis patients scheduled for posterior spinal fusion

surgery, the effectiveness of chewing gum in promoting bowel function recovery was investigated. Although the study did not find a positive effect of postoperative gum chewing on intestinal functions, it did report a positive effect on postoperative pain [14]. Another study, the effect of postoperative gum chewing on the development of ileus was investigated in patients over 65 years of age with hip fractures. The study concluded that postoperative gum chewing reduced the incidence of ileus [15]. In cardiovascular surgery, a study investigating the effect of chewing gum on intestinal function was conducted on transperitoneal abdominal aortic surgery patients. This study included 44 patients, divided into a control group (N = 21) and a study group (N = 23), that chewed gum three times a day. In this study, the authors found that flatus was passed on postoperative day (POD) 1.49 in the gum group and on POD 2.35 in the control group (P = 0.0004) and the time to oral intake was 3.09 days in the gum group and 3.86 days in the control group (P = .023). At the end of their study, the authors emphasized that chewing gum after abdominal aortic surgery positively affects intestinal function [16]. Unlike this study, we performed coronary artery surgery on our patients and the abdomen was not opened.

ERAS is a perioperative management protocol originally designed to improve patient recovery after colorectal surgery [17]. A study by Hendy et al. [6], it was revealed that the ERAS protocol can also be applied to cardiac surgery patients. However, the protocol covers a diverse group of cardiac surgery patients. A protocol suitable for the characteristics of this patient group is necessary [5]. Chewing gum is one of the items that should be applied postoperatively in the ERAS protocol. Further studies are needed in the field of cardiac surgery.

In our study, the number of bowel sounds before chewing gum in the 10th postoperative hour [6 (5-14)] was significantly lower than that after chewing in the 8th postoperative hour [10 (7-20)], but it was not much different from that before chewing [6 (3-14)] in the 8th postoperative hour. This result indicates that the stimulating effect of chewing gum on bowel sounds is short-lived.

Limitation

The most important limitation of our study is that it was a single-center which limited the number of patients. We found that postoperative gum chewing significantly reduced postoperative pain levels, which is important as it may help prevent complications like postoperative atrial fibrillation. In our study, bowel sounds were recorded by one person using a stethoscope. Automatic systems could not be used [18].

Conclusion

It is crucial to reduce morbid outcomes after CABG surgery. Chewing gum early after these surgeries may allow bowel functions to return earlier. It can also reduce pain levels. However, there was no significant effect on early discharge. Our study is the first to investigate the effects of early gum chewing after isolated CABG operations with cardiopulmonary bypass. Multi-center studies using electronic bowel sound recording systems and larger patient populations are needed.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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